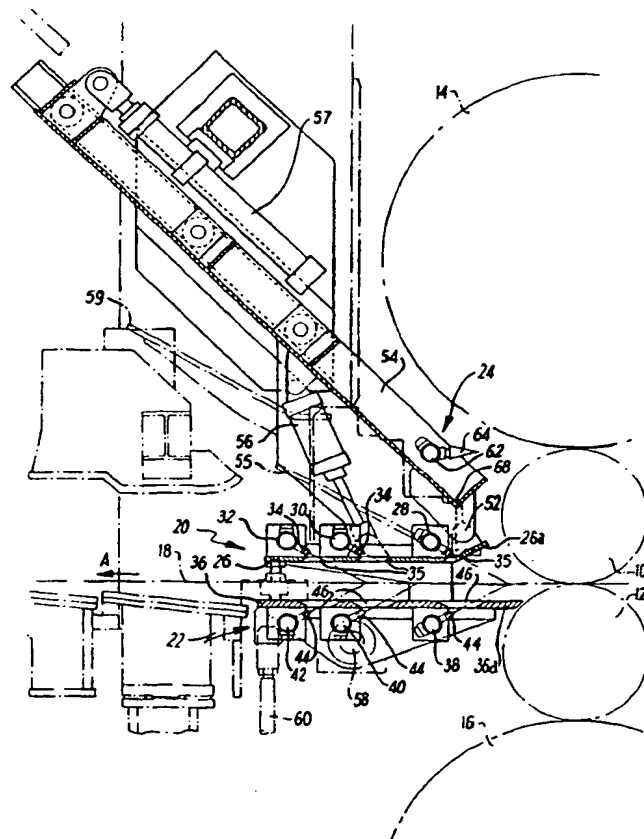


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(21) International Application Number: PCT/GB94/01774 (22) International Filing Date: 12 August 1994 (12.08.94) (30) Priority Data: 9316782.3 12 August 1993 (12.08.93) GB (71) Applicant (for all designated States except US): LAMBERTON AND COMPANY LIMITED [GB/GB]; Sunnyside Works, Coatbridge ML5 2DL (GB). (72) Inventors; and (75) Inventors/Applicants (for US only): TURNER, Charles, Stott [GB/GB]; Lamberton and Company, Sunnyside Works, Coatbridge ML5 2DL (GB). LEVER, Thomas, William [GB/GB]; Lamberton and Company Limited, Sunnyside Works, Coatbridge ML5 2DL (GB). (74) Agent: WOTHERSPOON, Graham; Murgitroyd & Co., 373 Scotland Street, Glasgow G5 8QA (GB).		(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, ES, FI, GB, GE, HU, JP, KE, KG, KP, KR, KZ, LK, LT, LU, LV, MD, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TJ, TT, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD). Published <i>With international search report.</i>

(54) Title: APPARATUS FOR USE IN ROLLING MILLS**(57) Abstract**

Strip material moves along a pass line (18) through work rolls (10, 12) of a rolling mill. The strip is sprayed with a lubricant before contacting the work rolls (10, 12). Apparatus for removing the lubricant and drying the strip after rolling and before reeling uses air jets produced by nozzle assemblies (20, 22) above and below the pass line (18). The nozzle assemblies (20, 22) are located in close proximity to the pass line (18). The air jets are substantially confined by wall elements lined with energy absorbing material (Fig. 4). The nozzle assemblies (20, 22) are mounted so as to be readily movable out of the vicinity of the roll stand.



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1 "Apparatus for use in Rolling Mills"

2

3 This invention relates to apparatus for use in rolling
4 mills for the purpose of removing fluids from the strip
5 surface at the exit side of the roll stand.

6

7 In the cold rolling of aluminium strip, it is
8 conventional to use a liquid lubricant such as kerosene
9 which is sprayed onto the strip at the input side of
10 the roll stand. It is desirable to remove the lubricant
11 and thus dry the strip before the rolled strip is
12 reeled; failure to do so may lead to the lubricant, or
13 more especially contaminants carried by the lubricant,
14 causing staining or spotting of the strip.

15

16 It is known to remove the lubricant by directing jets
17 of compressed air at the top and bottom surfaces of the
18 strip as it exits the roll stand. However, the known
19 apparatus for achieving this have not been entirely
20 satisfactory in achieving the desired quality of the
21 finished strip, and also have a significant
22 disadvantage of producing a large volume of spray or
23 mist of lubricant in the area of the roll stand.

24

25 An object of the present invention is to provide an

1 improved apparatus in which the foregoing disadvantages
2 are overcome or mitigated.

3
4 Accordingly, the present invention provides apparatus
5 for use in removing a lubricant from the surface of
6 strip exiting from a roll stand of a rolling mill, the
7 apparatus comprising upper and lower nozzle assemblies
8 positioned above and below the strip path to project a
9 pressurised fluid onto the upper and lower surfaces of
10 the strip in a direction towards the roll stand exit
11 and at a vertical angle which forms an acute angle with
12 the strip path the nozzle assemblies being positioned
13 adjacent the strip; and the apparatus further including
14 confinement means positioned around the discharge of
15 the nozzle assemblies to confine within the vicinity of
16 the strip at least a substantial portion of any
17 lubricant forced off the surface of the strip by the
18 pressurised fluid.

19
20 Preferably, said pressurised fluid is air and said
21 lubricant is a liquid.

22
23 Preferably, the apparatus includes a further nozzle
24 assembly positioned to direct pressurised air into the
25 bite between an upper work roll and an upper backup
26 roll of the roll stand.

27
28 In a particularly preferred form of the invention, the
29 containment means includes carrier plates for the
30 nozzles and end plates, and at least part of the
31 interior surface of the containment means is provided
32 with an energy absorbing material, suitably in the form
33 of wire mesh.

34
35 The nozzles are preferably arranged so as to create one
36 or more transverse rows of fluid impact areas which are

1 positioned so as to extend across the width of the
2 strip but without the impact areas overlapping.

3

4 The nozzle assemblies are preferably mounted in such a
5 manner as to be closely adjacent the strip path and the
6 roll stand exit when in use, while being readily moved
7 to inoperative positions allowing easy access to the
8 roll stand exit area.

9

10 An embodiment of the invention will now be described,
11 by way of example only, with reference to the
12 accompanying drawings, in which:

13

14 Fig. 1 is a cross-sectional side view of apparatus
15 forming one embodiment of the invention and part of an
16 associated roll stand of a rolling mill;

17

18 Fig. 2 is a plan view of an air nozzle assembly used in
19 the apparatus of Fig. 1, illustrating the jet pattern
20 produced by the air nozzle assembly;

21

22 Fig. 3 is a plan view of another air nozzle assembly
23 used in the apparatus of Fig. 1; and

24

25 Fig. 4 is a schematic end view of the apparatus of
26 Fig. 1.

27

28 Referring to Fig. 1, the apparatus of the present
29 embodiment is used in conjunction with a roll stand
30 having upper and lower working rolls 10 and 12 and
31 upper and lower backup rolls 14 and 16. The strip
32 travels through the roll stand along the path
33 indicated at 18 in the direction of the arrow A. The
34 rolling mill itself may be any conventional mill and is
35 therefore shown in outline in sufficient detail only to
36 indicate the relationship between the mill and the

1 apparatus of the present invention.

2

3 Lubricant is sprayed onto the strip in well known
4 manner at the entrance side to the roll stand by means
5 not shown. The apparatus of Fig. 1 is used to remove
6 the lubricant and dry the strip before the latter is
7 reeled on a reel stand (not shown).

8

9 The apparatus includes an upper nozzle assembly 20 and
10 a lower nozzle assembly 22 disposed above and below the
11 strip path. These assemblies are supplied with
12 pressurised air which is blown onto the strip, in a
13 manner to be described in greater detail below, so as
14 to blow the lubricant to the sides of the strip and
15 from there to blow it clear of the strip. The apparatus
16 also includes a backup roll nozzle assembly 24 which
17 directs pressurised air at the bite between the upper
18 work roll 10 and the upper backup roll 14, as will also
19 be described in greater detail below.

20

21 The upper nozzle assembly 20 comprises a carrier plate
22 26 on which are mounted three header bars 28, 30, 32
23 extending transversely of the strip. Each header bar
24 28, 30, 32 mounts a number of nozzles 34 directed
25 towards the top surface of the strip via apertures 35
26 in the carrier plate 26. Similarly, the lower nozzle
27 assembly 22 comprises a carrier plate 36 mounting
28 header bars 38, 40, 42 carrying nozzles 44 directed at
29 the bottom surface of the strip via apertures 46.

30

31 Each of the header bars is supplied with dry
32 pressurised air via suitable hoses (not shown), and the
33 pressurised air is discharged through the nozzles 34,
34 44 to remove lubricant from the strip. As seen in Fig.
35 1, the nozzles 34, 44 are disposed to discharge air at
36 a vertical angle α which is typically in the range 25°

1 to 35°.

2

3 Fig. 2 illustrates the disposition and effect of the
4 nozzles 34 on one header bar 28; the other header bars
5 are arranged in an identical manner. The nozzles 34 (in
6 this embodiment, nine nozzles on each header bar) are
7 disposed at varying horizontal angles to the strip axis
8 to produce air contact areas 48 on the strip 50 of
9 generally elliptical shape and at varying angles to the
10 strip axis across the width of the strip. This pattern
11 promotes flow of the lubricant to the sides of the
12 strip and thereafter detachment of the lubricant from
13 the sides of the strip. It will also be noted that the
14 air contact areas 48 overlap across the width of the
15 strip, but do not mix with each other. This arrangement
16 ensures that the whole width of the strip is wiped
17 while avoiding turbulence which would be produced if
18 the discharge from adjacent nozzles were allowed to
19 mix.

20

21 This pattern of air impact can suitably be produced by
22 nozzles having discharge openings of rectangular shape,
23 typically about 15 mm x 5 mm, supplied with air at a
24 pressure of the order of 4 - 5 bar.

25

26 Referring again to Fig. 1, the upper carrier plate 26
27 is hinged at 52 to a support member 54 and may be
28 pivoted about 52 to a position shown at 55 in phantom
29 by operation of an air cylinder 56. The support member
30 54 in turn is mounted for sliding movement by a
31 hydraulic cylinder 57 to an upper position shown at 59
32 in phantom. The lower carrier plate 36 is pivotally
33 mounted at 58 about which point it may be swung
34 anticlockwise by a hydraulic cylinder or the like (not
35 shown) operating through a connecting rod 60, after the
36 upper assembly has been withdrawn, into a substantially

1 vertical position. These movements of the upper and
2 lower assemblies take the present apparatus out of the
3 immediate vicinity of the roll stand in a simple and
4 convenient manner, to allow work to be carried out on
5 the roll stand such as changing rolls.

6
7 This mounting arrangement also has the advantage that,
8 in the event of a misfeed of the strip in the exit area
9 of the roll stand, the nozzle assemblies can readily be
10 swung clear to provide access for remedial action.

11
12 The support member 54 also acts as a mounting for the
13 backup roll nozzle assembly 24. The assembly 24
14 comprises a header bar 62 which is rotatably mounted in
15 the support member 54 and may be angularly adjusted (by
16 means such as a hand-driven rack and pinion, not shown)
17 to be aimed accurately at the bite between the upper
18 backup roll 14 and the upper work roll 10. The header
19 bar 62 carries a number of nozzles, as seen in Fig. 3,
20 comprising a central, fishtail shaped nozzle 64 and
21 angled side nozzles 66. The purpose of the assembly is
22 to avoid a build up of lubricant in the bite area which
23 would tend to be scattered or sprayed by the rotation
24 of the rolls. The angular adjustment of the assembly 24
25 allows it to be aligned with rolls of different sizes,
26 or to be adjusted to cope with wear of the rolls.

27
28 The support member 54 is formed in this embodiment as
29 an open-topped tray, which assists by intercepting
30 lubricant drops or mist which would otherwise fall
31 towards the strip, the intercepted lubricant then being
32 discharged by gravity through drain holes such as 68.

33
34 In the present embodiment, the upper and lower nozzle
35 assemblies 20 and 22 are positioned in close proximity
36 to the strip 50, typically in the range 50 - 250 mm and

1 preferably about 150 mm; this contrasts with prior art
2 arrangements in which air nozzles are typically
3 directed at the strip from a distance of the order of
4 1 m. This allows a much more accurate air blast
5 pattern and reduces the spread of lubricant spray and
6 droplets. The lubricant is further confined by
7 substantially enclosing the area of the nozzle
8 assemblies. As best seen in Fig. 4, the area in
9 question is closed at the sides by side plates 70 and
10 at the top and bottom by the carrier plates 26 and 36.
11 The upstream end of this area in the embodiment of
12 Fig. 1 is confined by a forward extension 36a of the
13 lower carrier plate 36 configured to act as a stripper
14 bar on the lower work roll 12, and an end portion 26a
15 projecting from the upper carrier plate 26 towards the
16 upper work roll 10. In an alternative, shown
17 schematically in Fig. 4, the upstream end of this area
18 is confined by a pair of vertical end plates 72 and 74
19 forming a narrow slot 75 for passage of the strip. A
20 similar arrangement may be disposed at the downstream
21 end of the area.

22
23 This arrangement substantially reduces the general
24 spread of lubricant spray or droplets. It is however
25 possible for such lubricant to bounce from the
26 confinement back onto the strip. To overcome this
27 problem, it is preferred to line at least part of the
28 area with an energy absorbent material as indicated at
29 76 in Fig. 4. The material 76 should be such as to
30 absorb the kinetic energy of impacting lubricant so
31 that the lubricant is retained in the area of the wall
32 and runs by gravity to a suitable discharge. A
33 preferred material for this purpose is a mesh of fine
34 stainless steel wire, but other material may be used,
35 such as bristles of metal or plastics which are
36 resistant to the lubricant material and the temperature

1 of operation.

2

3 The invention is of particular usefulness in the cold
4 rolling of aluminium strip, and has been shown to give
5 excellent results in rolling aluminium strip in widths
6 of 0.9 m - 2.0 m in finished thicknesses down to
7 0.2 mm. It is believed that the invention would be
8 useful also in other rolling processes such as the cold
9 rolling of steel strip.

10

11 Modifications may be made to the foregoing embodiment
12 within the scope of the invention.

13

14 For example, the air nozzles in a given transverse row
15 of nozzles may be supplied with pressurised air
16 independently, instead of via a common header. This
17 makes it possible to use different pressures at
18 different locations across the width of the strip,
19 suitably a higher pressure in the centre and
20 progressively lower pressures towards the sides. It
21 also makes it possible to disable the air supply to the
22 outer nozzles when rolling strip of a width less than
23 the full width capacity of the mill, thereby saving on
24 compressed air consumption.

25

26 The upper and lower nozzle assemblies may be
27 constructed so that the vertical and horizontal angles
28 of discharge of the nozzles may be adjusted. This
29 simplifies adjusting the apparatus to deal with
30 different thicknesses and widths of material.

31

1 CLAIMS

2

3 1. Apparatus for use in removing a lubricant from the
4 surface of strip exiting from a roll stand of a rolling
5 mill, the apparatus comprising upper and lower nozzle
6 assemblies positioned above and below the strip path to
7 project a pressurised fluid onto the upper and lower
8 surfaces of the strip in a direction towards the roll
9 stand exit and at a vertical angle which forms an acute
10 angle with the strip path the nozzle assemblies being
11 positioned adjacent the strip; and the apparatus
12 further including confinement means positioned around
13 the discharge of the nozzle assemblies to confine
14 within the vicinity of the strip at least a substantial
15 portion of any lubricant forced off the surface of the
16 strip by the pressurised fluid.

17

18 2. Apparatus according to claim 1, in which said
19 pressurised fluid is air and said lubricant is a
20 liquid.

21

22 3. Apparatus according to claim 2, including a further
23 nozzle assembly positioned to direct pressurised air
24 into the bite between an upper work roll and an upper
25 backup roll of the roll stand.

26

27 4. Apparatus according to any preceding claim, in
28 which the upper nozzle assembly includes a plurality of
29 nozzles mounted on an upper carrier plate, and the
30 lower nozzle assembly includes a plurality of nozzles
31 mounted on a lower carrier plate, each nozzle
32 projecting pressurised fluid via a corresponding
33 aperture in the respective plate; and in which the
34 containment means comprises said carrier plates and end
35 plates on either side of the strip path.

36

1 5. Apparatus according to claim 4, in which at least
2 part of the inner surface of the containment means is
3 provided with an energy absorbing material.

4
5 6. Apparatus according to claim 5, in which said
6 energy absorbing material is a layer of wire mesh.

7
8 7. Apparatus according to any preceding claim, in
9 which each of the upper and lower nozzle assemblies
10 comprises at least one row of nozzles disposed
11 transverse to the strip axis, the nozzles in the or
12 each row being so formed and positioned as to produce
13 on the surface of the strip a series of impact zones of
14 pressurised fluid extending generally transversely of
15 the strip at varying shallow angles to the transverse
16 direction of the strip so as to overlap in the
17 transverse but not in the axial direction of the strip.

18
19 8. Apparatus according to claim 7, in which each of
20 the upper and lower nozzle assemblies comprises three
21 transverse rows.

22
23 9. Apparatus according to claim 7 or claim 8, in which
24 each transverse row comprises a number of nozzles
25 mounted on and fed from a transverse header bar at a
26 common pressure.

27
28 10. Apparatus according to claim 7 or claim 8, in
29 which the pressure of fluid supplied to the nozzles of
30 a given row may be varied across the width of the
31 strip.

32
33 11. Apparatus according to any preceding claim, in
34 which the upper and lower nozzle assemblies are mounted
35 on upper and lower support means each movable between
36 an operative position in which the nozzles are closely

11

1 adjacent the strip path at the exit from the roll stand
2 and an inoperative position allowing access to said
3 exit.

4

5 12. Apparatus according to claim 11, in which the upper
6 nozzle assembly is pivoted on a support member disposed
7 above at an angle to the strip path, and the support
8 member is movable toward and away from the roll stand.

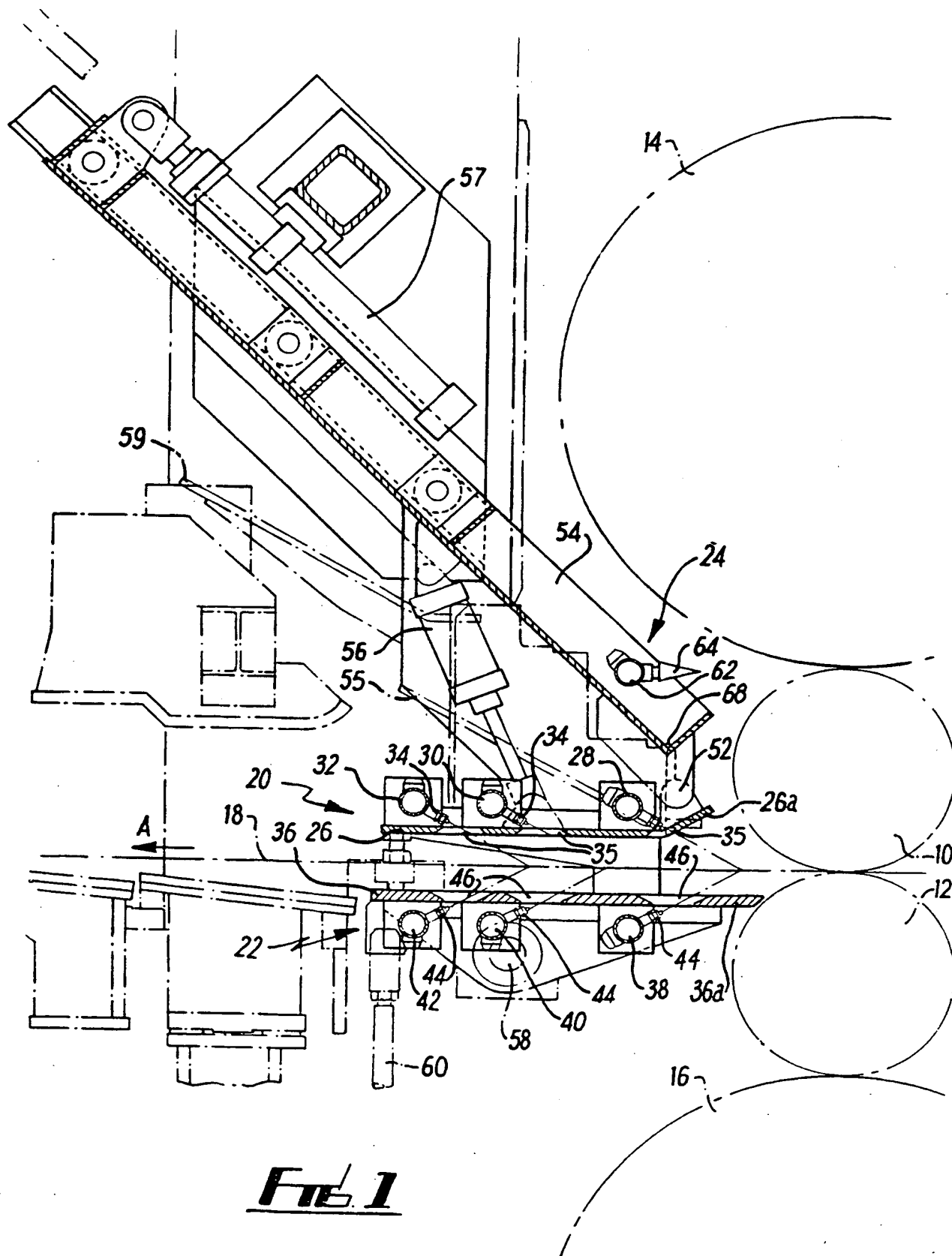
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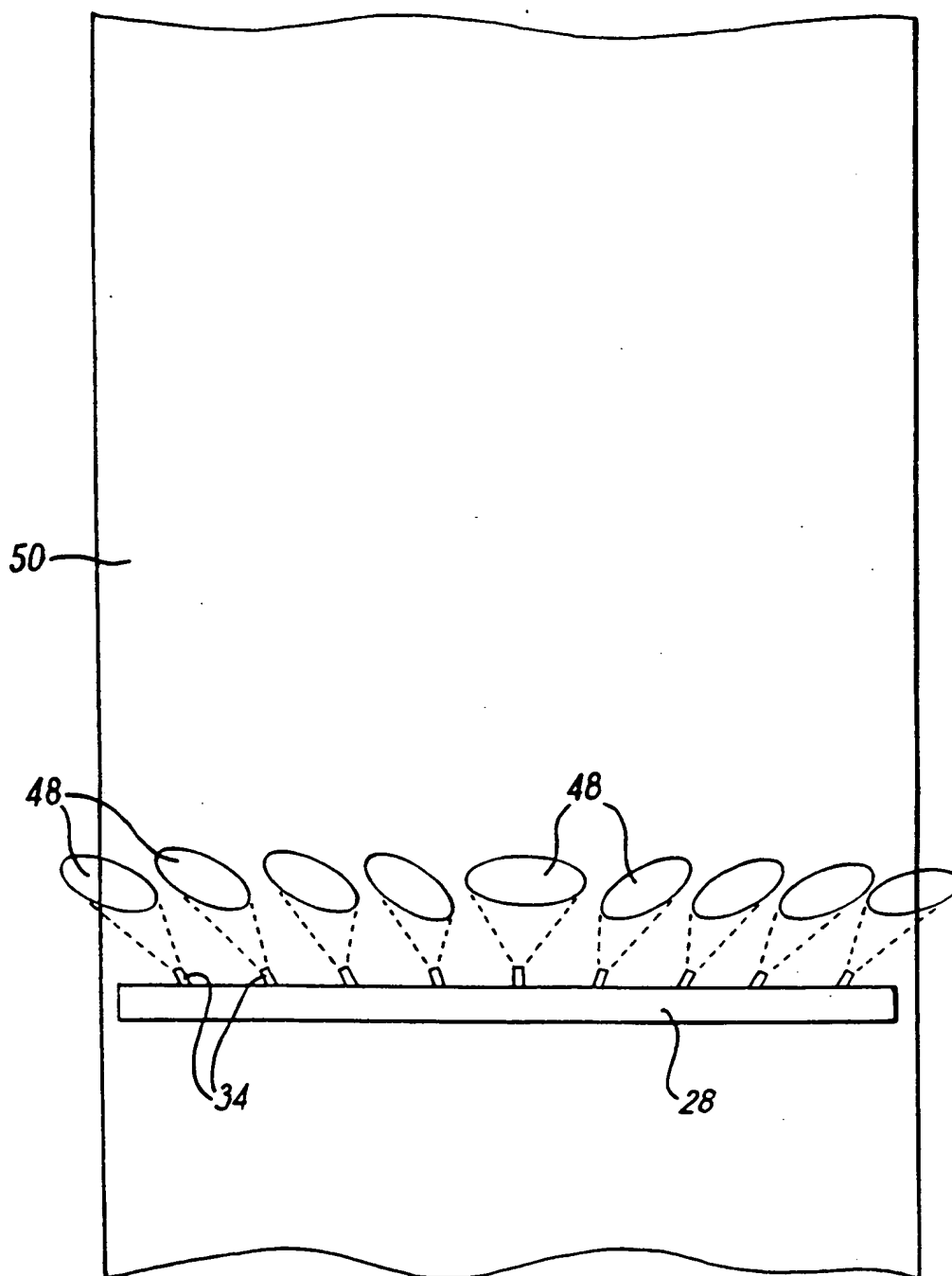
10 13. Apparatus according to claim 3 and claim 12, in
11 which the support member carries said further nozzle
12 assembly.

13

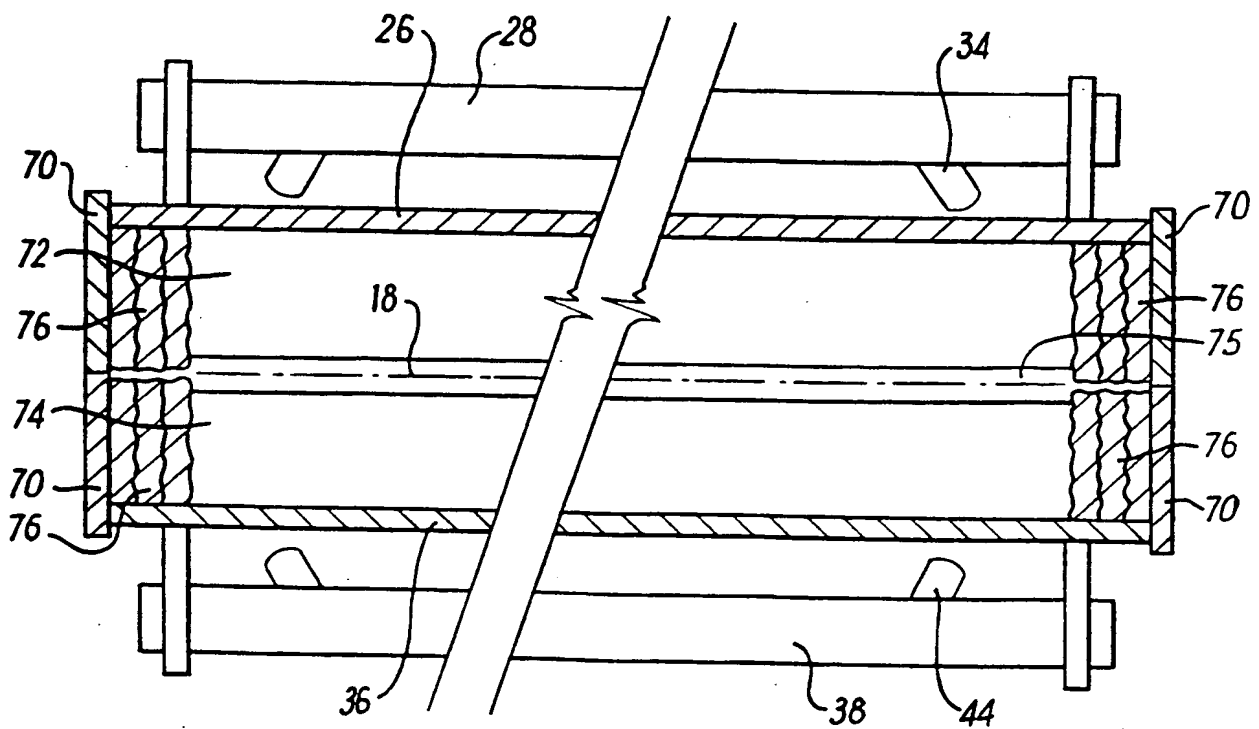
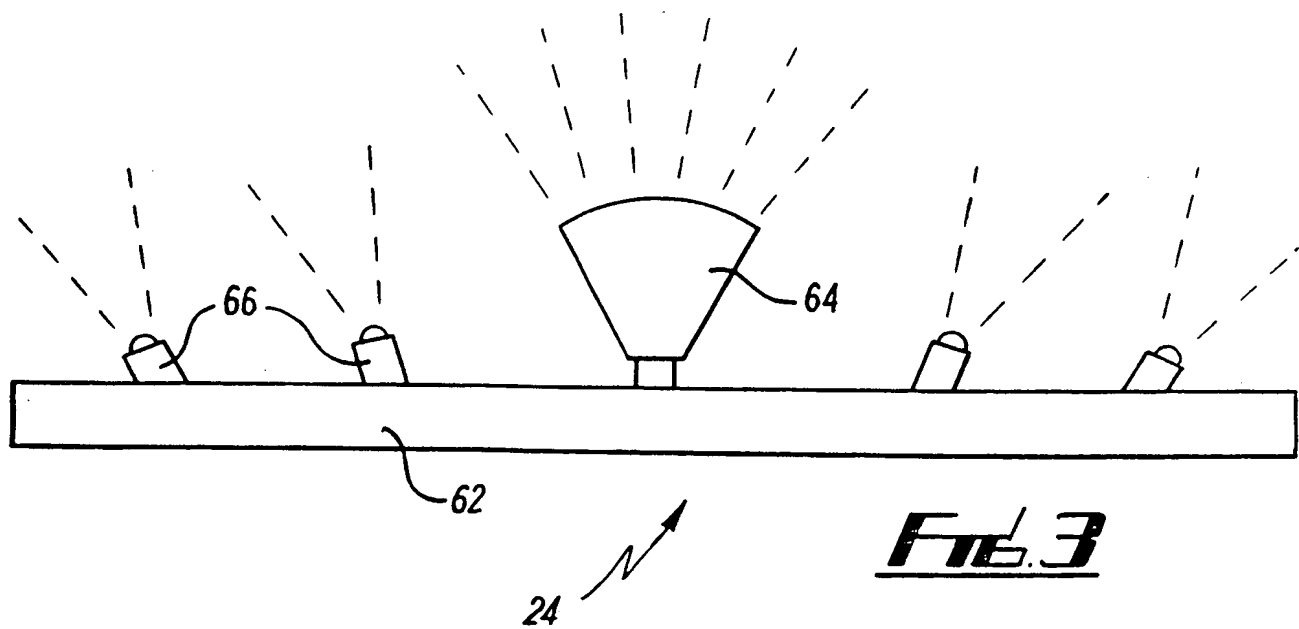
14 14. Apparatus according to claim 13, in which the
15 support member is in the form of an tray open towards
16 the upper backup roll.

17

***Fig. 1***

FIG. 2

3 / 3



INTERNATIONAL SEARCH REPORT

International Application No.

PCT/GB 94/01774

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B21B45/02 B21B27/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 B21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 4, no. 53 (M-008) 19 April 1980 & JP,A,55 022 434 (HITACHI) 18 February 1980 see abstract	1,2,4,7, 9,11
A	---	5,12
X	GB,A,2 111 885 (WEAN UNITED INC) 13 July 1983 see page 2 - page 4; figures 2,5-10	1,2,4, 11,12
X	US,A,3 192 752 (DOWD ET AL.) 6 July 1965 see column 3 - column 4; figures 1-4	1,2,4
A	---	3,5,7,9, 10,13
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Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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Date of the actual completion of the international search

16 November 1994

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 94/01774

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US,A,4 601 112 (KUSH ET AL.) 22 July 1986 see column 3; figures 1,1A	1,2,4
A	---	5,7,9
X	PATENT ABSTRACTS OF JAPAN vol. 8, no. 132 (M-303) 20 June 1984 & JP,A,59 033 022 (HITACHI SEISAKUSHO) 22 February 1984 see abstract	1,2
A	---	4,5
A	PATENT ABSTRACTS OF JAPAN vol. 4, no. 12 (C-71) 29 January 1980 & JP,A,54 145 355 (KOBE SEIKOSHO) 13 November 1979 see abstract	1-3,7,9, 13,14
A	---	
A	PATENT ABSTRACTS OF JAPAN vol. 3, no. 100 (C-56) 24 August 1979 & JP,A,54 078 348 (HITACHI SEISAKUSHO) 22 June 1979 see abstract	1,2,4,7, 9,10
A	---	
A	PATENT ABSTRACTS OF JAPAN vol. 17, no. 379 (M-1447) 16 July 1993 & JP,A,05 069 028 (KAWASAKI STEEL) 23 March 1993 see abstract	1-4,13
P,A	---	
P,A	PATENT ABSTRACTS OF JAPAN vol. 18, no. 254 (M-1605) 16 May 1994 & JP,A,06 039 422 (SUMITOMO LIGHT METAL IND.) 15 February 1994 see abstract	1-3,13

INTERNATIONAL SEARCH REPORT

Information on patent family members

Original Application No

PCT/GB 94/01774

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A-2111885	13-07-83	AU-A- 9091782 CA-A- 1230764 JP-A- 58110115 US-A- 4691549	30-06-83 29-12-87 30-06-83 08-09-87
US-A-3192752		NONE	
US-A-4601112	22-07-86	NONE	

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